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ABSTRACT

The efficacy of the random digit dialing method in telephone surveys was examined. Random digit dialing (RDD) generates a pure random sample and provides the advantage of including unlisted phone numbers, as well as numbers which are too new to be listed. Its disadvantage is that it generates a major proportion of nonworking and business numbers--about four in five. Although a number of RDD sampling strategies have been proposed, they all lack a means of classifying those numbers at which there is never an answer. They could be outside the sampling range (businesses or nonworking numbers) or households whose members are rarely home. The computation of response rates is a major problem, however, especially since many surveyers want a minimum response of 50 percent. This study examined the validity of the approach which distributes never-answered numbers in the same proportion as those answered. Five surveys were conducted in Sacramento and Santa Cruz (California) during evening and weekend hours, and then a followup was made during business hours. Results indicated that nonworking telephone numbers were generally identified during the regular (evening and weekend) calling hours. Business numbers were difficult to identify, and were probably understated. This proposed method was not recommended. (GDC)

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RESPONSE RATES IN RANDOM-DIGIT-DIALED TELEPHONE SURVEYS

Estimation vs. Measurement

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INTRODUCTION

Background

Both historically and to a not inconsiderable extent in current thinking and practice, the preferred method of survey research data collection has been the personal or face-to-face interview. In the past two decades, however, the telphone survey method has gained both in popularity and in acceptance.

According to Waksberg (1978:73), the "main motivation" behind the increasing use of telephone surveys is avoiding the substantially higher cost of personal interviews. As much of a motivator as cost may be, however, it is by no means the only one contributing to the trend toward telephone surveys. Speed, management efficiencies, the relatively ready accessibility of geographically dispersed respondents, and enhanced quality control are also benefits of the telephone method. (Dillman, 1978; Freeman, et. al., 1982; Sudman, 1966)

The increasing use of the telephone survey method has led to an extensive exploration of its relative advantages and disadvantages in the survey research literature. Among the concerns that have been raised and debated is the extent to which various sampling strategies adequately cover all telephone households.[1] Two basic methods exist for drawing telephone survey samples: directory sampling (from alphabetical or "criss-cross" [street] directories) and random digit dialing (RDD). The latter, Cooper's (1964) "ingenious method" as it was described by Perry (1968), was developed in order to eliminate the biases inherent in directory sampling. Both methods are used currently, the former primarily because it is less costly, and perhaps also because some researchers either are unaware of its biases or lack the technical capability to construct RDD samples efficiently.

Because the biases of directory samples, most notably the exclusion of those who move and those who for one reason or another are unlisted, are substantial, RDD sampling has become the unquestionably preferred approach. However, this form of sampling, in whatever manner it is implemented (and there are several variations on Cooper's innovative theme currently in use), is not without its problems as well. It is the most vexing and intractable of these problems that prompted the research reported in this paper.

The Problem

Random digit dialing as proposed by Cooper, sometimes referred to as "pure" RDD, involves the attachment of four random digits to known area code-central office (ac-co) combinations in order to create a new, randomly selected sample element, as follows:

___ ___ ___	-	___ ___ ___	-	___ ___ ___ ___
AC (Known)		COC (Known)		Random Digits

The advantage of this technique is that it will encompass voluntarily unlisted numbers, involuntarily (erroneously) listed numbers, and numbers that are too new to be listed. Further, because it generates a pure random sample, it has a deft (square root of the design effect) of 1 (Cummings, 1979). The disadvantage of this method is that it generates a major proportion of non-working and business numbers - usually about four in five (Groves, 1978). As as result, substantial interviewer time and cost are wasted on fruitless dialings.

Because of this disadvantage, a number of modifications of Cooper's method have been advanced. Yet although these modifications improve implementation efficiency, they tend either to be cumbersome (and therefore costly to utilize)

or to increase the sample's deft. Only the pure and random stratified strategies, both of which produce large numbers of ineligible elements, appear to be both valid and relatively reasonable to implement.

Beyond the rather intricate debate over the relative merits of the various RDD sampling strategies, however, lies a problem common to all RDD samples: the fact, originally pointed out by Glasser and Metzger (1972), that one has no way of knowing how to classify those numbers at which there is never an answer. Unanswered numbers could be either outside the sampling frame (e.g., nonworking numbers, businesses) or household sample members that are rarely home, or perhaps on vacation. As a result, the integrity of the sample is compromised (Groves, 1978).

For the practicing researcher, the more theoretical problem of sample integrity is usually overshadowed by a concrete and practical problem: the inability to compute response rates. The computation of *completion* rates in RDD telephone surveys poses no partiuclar problem, as this rate is simply defined as follows:

$$\text{Completion Rate} = \frac{\text{Number Completed}}{\text{Number in Sample}} \qquad \text{(Frey, 1984)}$$

Thus if 2,500 random numbers are generated and 400 interviews are completed, the completion rate is:

$$\frac{400}{2,500} = .16$$

For clients used to hearing that 50 percent is the absolutely *minimum* necessary response for generalization, however, this type of calculation can be most

distressing. Moreover, and perhaps more important, the calculation is substantially misleading, because while it is a reasonable measure of implementation, it is not a reasonable measure of response.

The measure of response, quite correctly, is calculated as:

$$\text{Response} = \frac{\text{Number Completed}}{\text{Number of Eligibles in Sample}}$$ (Frey, op. cit.)

The problem that arises in RDD surveys, however, is that this calculation cannot technically be performed because the number of eligibles in the sample is unknown. Any number at which no answer is obtained during the course of a survey can conceivably represent either an eligible household or a non-eligible sample element (e.g., a non-working number with a dysfunctional recording or a business). Modifications of pure RDD provide relief, but no solution.

One traditional solution, recently proposed by the Council of American Survey Research Organizations (CASRO) as a standard for the profession, calls for distributing never-answered numbers in the same proportion as those that were answered in order to estimate the rate of eligible and ineligible units. That is, if ten percent of the answered numbers were non-working, ten percent of the never-answered numbers would be presumed to be non-working. The purpose of the research presented in this paper was to test the validity of this approach, specifically as it applies to business numbers. The reasons for the selection of this particular piece of the never-answered puzzle were that business numbers present a unique and particularly troublesome case for those who undertake public or community opinion research, which is most appropriately conducted in the evenings and on weekends,[2] and that the presence of businesses among the never-answered numbers in a typical public opinion survey should be fairly readily amenable to detection.

METHOD

The samples used in this study were five pure RDD samples used in conducting public opinion or marketing research surveys. Specifications for the surveys and their samples are presented in Table 1.

TABLE 1
SURVEY AND SAMPLE SPECIFICATIONS

Topic of Survey	Time Frame	Total RDD Numbers	Number of Interviews Completed
Dining Out	July, 1984	1357	300
Public Transportation	July, 1985	2960	500
Bedding	August, 1985	4560	400
Loneliness	September, 1985	3600	400
Public Schools	October - November, 1985	1655	401

All of the surveys were conducted during the evening hours (5-9 p.m. Monday through Thursday) and on weekends (10 a.m. to 6 p.m. on Saturday and 2-9 p.m. on Sunday). During the surveys concerning dining out, public transportation and bedding, up to four attempts were made on different days and at different times of day in order to reach a potential respondent at each sample number; up to three attempts were made during the loneliness and public school surveys.

After each survey had been completed, all of the never-answered numbers were called an additional time during regular business hours (9 a.m. - 5 p.m.). The results of these additional, daytime calls represent the data for the research presented here.

FINDINGS

Table 2 shows the percentages of businesses identified during the regular calling periods (evenings and weekends) and during the experimental calling periods (regular business hours).

TABLE 2

IDENTIFICATION OF BUSINESSES IN SAMPLE

SURVEY	SURVEY CALLING PERIODS (Evenings and Weekends)			EXPERIMENTAL CALLING PERIODS (Regular Business Hours)		
	Total Numbers Called	Number of Businesses Identified	Percent of Total	Total Numbers Called	Number of Businesses Identified	Percent of Total
Dining Out	1,357	212	15.16%	190	89	46.8%
Public Transportation	2,960	248	8.4%	393	36	9.2%
Bedding	4,560	437	9.6%	611	28	4.6%
Loneliness	3,600	302	8.4%	573	161	28.1%
Public Schools	1,655	82	5.0%	230	8	6.2%
TOTALS	14,132	1,281	9.1%	1,997	322	16.1%

To carry the discussion somewhat further, these data can be compared with the identification of non-working numbers, as portrayed in Table 3 on page 7.

TABLE 3

IDENTIFICATION OF NON-WORKING NUMBERS

SURVEY	SURVEY CALLING PERIODS (Evenings and Weekends)			EXPERIMENTAL CALLING PERIODS (Regular Business Hours)		
	Total Numbers Called	Number of Non-Working Numbers Identified	Percent of Total	Total Numbers Called	Number of Non-Working Numbers Identified	Percent of Total
Dining Out	1,357	632	46.6%	190	9	4.7%
Public Transportation	2,960	1,423	48.1%	393	17	4.3%
Bedding	4,560	2,220	48.7%	611	12	2.0%
Loneliness	3,600	1,651	45.9%	573	70	12.2%
Public Schools	1,655	333	20.1%	230	122	53.0%
TOTALS	14,132	6,259	44.3%	1,997	230	11.5%

The only relatively consistent pattern that emerges from these data is the identification of non-working numbers during regular survey calling periods in all but one of the surveys. Insofar as businesses are concerned, regular calling tended (as would be expected) to understate the presence of businesses in the sample, but this finding was not consistent over all surveys. Moreover, the degree of understatement varied widely from survey to survey.

With respect to the identification of non-working numbers, although the pattern during regular calling hours was quite consistent, the pattern during the experimental calling hours was also highly variable. Nonetheless, as might have been predicted, non-working numbers tended to be primarily identified during the regular calling period.

CONCLUSIONS AND IMPLICATIONS

Both of the sets of data presented in the preceeding section strongly suggest that distributing never-answered numbers in the same proportion as answered numbers can be both inaccurate and substantially misleading. However, neither the strength nor the direction of the bias this approach leads to is clear, despite the examination of five different surveys conducted over a period of approximately a year and a half. Accordingly, this research does not give us grounds for proposing an alternative strategy. Future research will need either to continue the present line of inquiry over more samples and a broader geographic area[3] in order to determine whether the rates will stabilize across more replications or to explore entirely different approaches to dealing with never-answered numbers.

FOOTNOTES

[1] The issue of the extent to which the existence of non-telephone households biases telephone survey results, although related, is separate from the topic of this paper. In general, it is the author's opinion that concern with the effect of non-telephone households is largely an historical artifact. However, for studies requiring substantial precision, non-telephone households undoubtedly remain a factor.

[2] Some public opinion research organizations will make the initial call to each sample element during the day in order to improve efficiency by immediately eliminating most businesses. However, because the author believes that this approach jeopardizes the eventual respondent distribution in the absence of complex and costly within-household respondent selection procedures, the author's organization has not adopted it.

[3] Four of the surveys reported on here were conducted in the Sacramento, California metorpolitan area; one was conducted in the vicinity of Santa Cruz, California.

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